UNIFICATION AND WORD-INTERNAL PRAGMATICS

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Abstract

Recent important developments within Discourse Representation Theory include a more elaborate formalisation and account of presuppositional phenomena, as well as the integration of unification as a mode of composition. Focusing on these issues, the following claims are made: (i) the varying compositional impact of some adverbials, ranging from merely constraining the properties of a predicate to radically altering them, is suitably modeled applying unification, and (ii) pragmatic mechanisms like bridging, presupposition verification and accommodation can apply word-internally for some lexical items. To substantiate these claims, the analysis will centre around the German causal preposition *durch* ('by', 'through', 'by means of').

1 A challenge to strict compositionality

An adverbial can be said to be a free syntactic constituent which modifies a predicate semantically. However, some adverbials not only modify a predicate, but may even radically alter its properties. Prepositional adjuncts headed by the German causal-instrumental preposition *durch* ('by', 'through', 'by means of') belong to one such class of adverbials (cf. section 5 for further examples). One of the main functions of *durch* is to mark its complement as the causing event in a causal relation between two events, as exemplified below:

(1) Der Polizist wurde getötet durch einen Schuss aus der eigenen Dienstwaffe.
   'The policeman was killed by a shot from his own service weapon.'

(2) Der Polizist starb durch einen gezielten Schuss.
   'The policeman died through an accurate shot.'

In (1), the causative predicate *töten* ('kill') is used, which implies the existence of a causing event without specifying it, i.e. it is manner-neutral. The semantics of
a phrase such as *einen Polizisten töten* ('to kill a policeman') can be specified as in (3), ignoring aspects which are not of immediate relevance here:

\[ \lambda e_1 \exists e_2 [\text{BECOME}(\text{dead}(p))(e_2) \land \text{CAUSE}(e_2)(e_1)] \]

In prose: the set of events \( e_1 \) such that there exists an event \( e_2 \), which is a death of \( p \), and where \( e_1 \) causes \( e_2 \). The modifying *durch*-adjunct provides a specification of the event \( e_1 \): the death of the policeman is caused by the event of a shot from his own service weapon.

In (2), the inchoative predicate *sterben* ('die') is used. Inchoatives like *sterben* are not generally assumed to imply a causative relation. The semantics of *sterben* ('die') may be represented formally as in (4), i.e. without a CAUSE predicate:

\[ \lambda y \lambda e_2 [\text{BECOME}(\text{dead}(y))(e_2)] \]

Still, in combination with the *durch*-adjunct, a semantics parallel to the one indicated for (1) is desirable: a shooting event is the cause of the policeman's death. Additionally, an inchoative like *sterben* does not associate with an agent on its own. But sentence (2) clearly implies the presence of an agent, as the specification of the shooting event as being 'accurate', indicates. Thus, the *durch*-phrase can be said to have altered the properties of the inchoative predicate *sterben*.

Accordingly, the semantics of both (1) and (2) can be represented as indicated in (5), again leaving out information not relevant to the discussion here:

\[ \lambda e_1 \exists e_2 [\text{BECOME}(\text{dead}(p))(e_2) \land \text{CAUSE}(e_2)(e_1) \land \text{SHOOT}(e_1)] \]

However, since inchoatives are not assumed to imply causation, there must be two different sources for the abstract predicate CAUSE: with causatives it originates in the predicate itself, but with inchoatives, the preposition seems to be the most plausible candidate for its introduction. But if *durch* in some cases should include a CAUSE of its own, principles of strict compositionality would seem to force us to assume an ambiguity between two *durch* prepositions since no iteration of the CAUSE predicate is assumed after the composition of *durch* with causatives: We do not get an interpretation involving indirect causation in a cause-to-cause-relation. Assuming ambiguity would, however, clearly be somewhat counter-intuitive, given the parallel interpretation of (1) and (2). Thus, other means of composition for *durch*-phrases and the predicates they modify, should be explored.
2 Alternative approaches

There exist approaches which could be seen as avoiding the problems posed by the data in (1)-(2). In the following, I will comment briefly on two of these, offering further arguments for the view to be taken here.

A first alternative is to assume a principle of temporal coherence as e.g. Wunderlich (1997, p. 36) does. This way a CAUSE predicate can enter into semantic composition whenever there is a constellation where a process (immediately) precedes a resultant state, where the predicate BECOME occurs. From this perspective, the CAUSE element occurs as a result of the combination of the BECOME predicate in the representation for inchoatives like sterben and the event of the shot, introduced by the durch-phrase. This means that durch itself does not need to contain a CAUSE element for inchoatives and causatives to come out much the same when combined with durch.

In another alternative it is assumed, somewhat simplified, that every change involves a CAUSE at some level, under the assumption that "even if no specific causing entity or action is expressed, something must be responsible for the change of state in the affected entity" (Härtl 2004: 899 ff.). Härtl, arguing for a division between a semantic and a conceptual level, claims that whenever a CHANGE predicate is present, a CAUSE predicate is introducable.

However, I think there are some facts concerning durch which render these approaches less attractive. In addition to the combinatorial possibilities of causal-instrumental durch briefly discussed in the previous section, the preposition may also be combined with stative predicates, as in (6):

(6) Auch der durch diese Haltung hohe Luftwiderstand kann auf längeren Strecken ganz schön schlauchen.

'The high air resistance due to this posture may put you through the mill over longer distances.'

In cases like (6), one gets an interpretation where the state expressed in the lexical anchor hoch (Eng. high), is the resultant state of the eventuality expressed in the internal argument of durch, in this case: Haltung (Eng. posture).

If the durch-phrase is left out, as illustrated in (7), the stative hoch should not be interpreted as a resultant state as such – though this could be achieved by (intonationally) focussing hoch, introducing a set of alternatives which are related to high through scales or negation.

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1 Haltung has both a stative and an eventive reading. It has an eventive, intergressive (Egg 1995) reading in contexts where the position is upheld deliberately, as in (6).
In the light of the noun phrase in (7), it seems reasonable to claim that *durch* has a similar effect in the case of the stative *hoch* in (6) as with inchoatives. A CAUSE can be assumed to be present, and *durch*'s internal argument expresses the causing event in the causing relation.

If one were to follow the above approaches, one would be left in a situation where one would have to do a lot of reinterpretation, in order to get a CAUSE element introduced into semantic composition. But in (6) it is hard to see what could plausibly trigger the reinterpretation, apart from *durch*.

An intuitively more plausible analysis can be achieved if we allow *durch* to introduce the CAUSE element. This CAUSE element would be the driving force of reinterpretation. If a CAUSE relation is present, one would expect a stative predicate to be reinterpreted as being a resultant state (Kratzer 2006). The reinterpretation of the stative predicate would thus follow automatically from the presence of the CAUSE element in *durch*, as in standard counterfactual analyses (Lewis 1973).

Another point in case for the plausibility of including a CAUSE in the semantics of *durch* is the reinterpretational effects *durch* has on its internal argument, which is the semantic correspondent of the preposition's syntactic complement. Normally, the internal argument of *durch* is an event noun. But *durch* can also have non-event-nouns as arguments, in which case these nouns will be reinterpreted as involving events (the relevant *durch*-phrase is printed in boldface):

(8) Wer über das nötige finanzielle Langzeitpolster verfügt, kann durch die Wahl des Wohnortes und die Gestaltung der Wohnung den Risiken auszuweichen versuchen (oder durch Zweitwohnung, Ferien etc.).

'Whoever has the necessary long-term financial cushion at hand can attempt to avoid the risk through the choice of a place of residence or the set-up of the residence itself (or through a second house, vacations, etc.).'

In (8), the phrase *durch Zweitwohnung* ('through a second house') is interpreted e.g. as *through the purchase of a second house*, i.e. as an event which involves the entity *second house*. If *durch* includes a CAUSE, we will have a straightforward explanation of why this reinterpretation takes place, since CAUSE is a relation between two events.

In light of examples such as (6) and the reinterpretational effects of *durch* in general, it seems reasonable to assume a CAUSE predicate to be included in the
semantics of durch. The question I will turn to in the next section, is how this quality of durch can be retained for all its causal and instrumental uses, i.e. how one can deal in a compositional manner with the fact that durch includes a cause predicate which is not always needed or wanted, as with causatives.

3 A unificational analysis

To deal with this challenge, the semantics of durch will be analysed by means of unification in Discourse Representation Theory (Bende-Farkas & Kamp 2001), applying principles of the presuppositional analysis of Kamp (2001) and Sæbø's (to appear) analysis of by. Building on work by van der Sandt (1992), Kamp assumes that semantic information in a sentence is processed bottom-up via a storage algorithm. Semantic information represented preliminarily in the store part enters a main content part as it is bound, verified or accommodated, for which Kamp uses the general term justification. The general representational format of Kamp (2001) for a semantic node in a tree structure is shown in (9):

\[
\text{content, store}
\]

\[
\text{variable, constraint, binding condition, content}
\]

A semantic node representation consists of a pair of a content and a store element. The content is always a Discourse Representation Structure (DRS). The store is a set of one or more elements, each being a triple of a variable, a set consisting of one or more constraints (a DRS) and a binding condition. Binding conditions determine which variables can enter a binding relation, and constraints contain semantic information which restrain the possible bindings further. In addition to the binding mechanism, a principle which unifies variables and constraints when possible, is assumed.

This machinery allows a unified analysis of the above uses of durch where the preposition indeed includes a cause of its own. When combined with a causative predicate, the implicit cause of durch is not added to the content part since there is a cause present in the predicate. However, the combination of durch with an inchoative leads to the projection of the cause element in the content part. The actual formalisation is illustrated briefly below. Durch may be represented as in (10):

\[
\text{Durch may be represented as in (10):}
\]

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2 It might e.g. be the specification of gender features which are crucial for the correct binding of pronouns.
Durch has no content of its own - its content part is empty -, but it includes two event variables and a temporal variable in the store. The two event variables are further specified as entering a CAUSE relation. The binding conditions $\lambda_1$ and $\lambda_2$ indicate that the variables need to be bound. When the complement of the preposition is added, as in durch einen Schuss, the event expressed therein binds $e_1$ and the information in the noun is added as a further constraint on the causing event: SHOT($e_1$) (cf. Chung & Ladusaw 2004, where the term restriction is used). When a durch phrase is combined with a causative predicate which has a completely parallel store part, the variables of durch and their constraints will eventually be unified with or be bound by the variables of the causative predicate. The representation of töten is given in (11).

The causing event $e_1$ of durch will first bind the event in the complement of durch, before being unified with the causing event of the predicate ($e_3$), whereas the caused event $e_2$ will bind the caused event of the predicate ($e_4$). Additionally, the constraints of the predicate and the preposition are merged and - where applicable - unified. After binding and unification have occurred, the actual contribution of a durch phrase, as compared to the information provided by the predicate alone, is restricted to the specification of the causing event given by the constraint SHOT($e_1$). Turning next to the inchoative predicate, its store part includes only one event ($e_3$), which will be bound by the caused event $e_2$ of durch.

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3 Under the assumption of a Kratzer (1996) style analysis, no agent is part of the semantics of the predicate itself. The agent is contained in the specifier position of a functional projection termed VOICE, which is situated above the VP, but below any temporal or aspectual projections.

4 The binding condition indef indicates that these variables can, but need not enter a binding relation.
In this case, the variable of the causing event of durch will be added to the content, since there is no event for it to be unified with. Furthermore, the cause relation of which the bound event variable of the inchoative predicate will be a part, will also enter the content, along with the aforementioned constraint derived from the internal argument of the preposition.

4 Sentence- and word-internal pragmatics

This treatment of durch amounts to analysing its implicit cause element as a sentence-internal presupposition. A durch phrase can be said to assert the event included therein and presuppose that this event is a cause of some other event. The common basis for generally assumed mechanisms for presuppositional behaviour and the compositional unification-based analysis of durch is as follows: When combined with causatives, durch seems to lack a meaning of its own. This is due to the unification of the cause of durch with the cause of the predicate, which is parallel to presupposition verification. In combination with inchoatives, however, durch does seem to make a greater contribution, where a cause predicate is introduced by the causal preposition itself. Here, a parallel to context accommodation can be observed.

Importantly, a pragmatic account of the combinatorial potential of durch can capture some further properties of the preposition which have previously been ignored or not correctly identified. Two additional pragmatic mechanisms involved are bridging and acceptability. In example (6) from section 2, here repeated for convenience as (13), bridging (in the wider sense of Bittner (2001), cf. also Clark (1977)) can be argued to take place. What is seen as bridging here, is the fact that the cause associated with the preposition forces a reinterpretation of the state described in the predicate hoch ('high') as being a caused resultant state: 5

(13) Auch der durch diese Haltung hohe Luftwiderstand kann auf längeren Strecken ganz schön schlauchen. 'The high air resistance due to this posture may put you through the mill over longer distances.'

5 This is standardly described as coercion in the semantic literature on aktionsart. Bittner (2001) chooses to describe this as bridging.
In (14)-(15), it can be seen that claims made in the literature that *durch* generally cannot be combined with manner-specific causatives (Härtl 2001) are not correct:

(14)  ??Er wurde durch einen Schuss erschossen.  
'He was shot dead with a shot.'

(15)  Er wurde durch einen Genickschuss erschossen.  
'He was shot dead with a shot to his neck.'

The well-formedness of such combinations should not be explained by reference to the semantics of *durch*. A more general account of the distribution in (14) and (15) is achieved by assuming that composition is restrained by a general pragmatic mechanism of acceptability as described by van der Sandt (1992: 367 ff.). The verb *erschießen* is a causative predicate, where the causing event is specified as being a shooting event. Thus, *erschießen* can be said to be a manner-specific causative, as opposed to the manner-neutral *töten*. Modifying a predicate such as *erschießen* ('shoot dead') by an adjunct like *durch einen Schuss* ('with a shot') is uninformative and thus unacceptable. The adjunct contains no information which is not included in the predicate. However, a specification such as *durch einen Genickschuss* ('with a shot to the neck') renders the adjunct more specific than the shooting event described in the predicate, adding to the content. A *shot to the neck* describes not only a shooting event, but also specifies the direction of the shot. Thus, the distribution of *durch* phrases in combination with manner-specific causatives does not have to be accounted for by reference to the semantics of *durch* itself, but can be seen as fully determined by acceptability restrictions.

The application of pragmatic mechanisms in explaining the compositional behaviour of *durch* has additional benefits as compared to an analysis based on unification alone. This is the case in examples involving indirect causation, where it is plausible to assume that two causes occur:

(16)  Der Kommandant ließ die Gefangenen durch eine Sprengung töten.  
'The commandant had the prisoners killed by means of an explosion.'

In (16), two causative predicates are used: *lassen* ('let'), which can be compared to the causative uses of *have* in English, and *töten* ('kill'). Two interpretational variants are available for (16). They both have in common that the commander is the agent of some event, which causes someone else to kill the prisoners. In the first variant, which is the most plausible one, it is additionally assumed that the explosion was the event that killed the prisoners. As in the above cases, the
CAUSE-presupposition of the *durch*-phrase would be verified by the CAUSE of *töten*. The other, more marginal interpretational variant of (16), is one where the explosion is not part of the killing event, but rather modifies the causing event of which the commander is the agent, expressed in the *lassen* predicate, i.e. the commandant somehow uses the explosion to make someone else kill the prisoners, in whatever way. In this case, the CAUSE-presupposition of *durch* will be verified by the CAUSE of *lassen*.

A case like (16) would however be potentially troublesome if unification is applied. It is preferrable if unification is allowed to occur whenever it can, limited by general constraints on unification, such as e.g. a demand on non-conflicting features. Thus, in the formalisation described above, as in any other unificational framework, the two CAUSE predicates and the CAUSE of *durch* would be unified unless some (ad hoc) principles are defined to avoid unification. This would run against the actual interpretation of (16).

It has been argued here that the kind of unification which is a plausible basis for the analysis of *durch* can be seen as presupposition justification. This view also allows a restriction of the processes which determine unification in a non-ad hoc way (though still not very clearly defined). Van der Sandt (1992) argues that resolution does not always have to occur. It is certainly the preferred operation over accommodation, but accommodation might under certain conditions occur when resolution is possible. What these conditions are, is not an easy matter to settle, but in the case of (16), it might be argued that there is a simpler expression without *lassen* which is available for direct causation, and that unifying the two CAUSEs of the predicates and resolving the presupposed CAUSE of *durch* with these would imply a lack of belief in the informativity of sentence (16) on the hearer's side.

It should be emphasised that in the above examples, all pragmatic mechanisms assumed to account for the compositional behaviour of *durch* apply purely sentence-internally. What is more, the presupposition resolution which has been argued for here, occurs at a word-internal level, involving a decomposition of the semantics of lexical items by means of the predicates CAUSE and BECOME. Thus, the above approach can be said to truly involve lexical pragmatics (Blutner 2004), where not only the pragmatic aspects of some lexical items are discussed, but lexical composition itself is viewed as being pragmatic in nature.

It might be questioned whether this is really a kind of presupposition. At this point, I have nothing much to say in my defence, this part of the article indeed being work in progress. It is however, not straightforward to establish this relation, since many of the normally applied tests for presuppositions are not

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6 Alternatively, applying default unification (Bouma 2006) might be seen as a way of avoiding this problem.
applicable in the case of durch.\footnote{See Beaver (2001: 18-20) and Geurts (1999: 6-10) for some general comments on the problem of testing for presuppositions and delimiting them from other semantic or pragmatic phenomena.} The pragmatic mechanisms which are argued to be relevant here, apply at the word-level, whereas most presuppositional phenomena which have been treated in the literature belong to the sentence-level. They can only be evaluated at the top-most CP-level and often only apply intersententially. But the resolution of the CAUSE-presupposition of durch can be argued to rather happen at VP-level, before the topmost eventuality is existentially closed. Thus tests involving e.g. embeddedness do not make much sense in the case of word-internal pragmatics. Connected to this, since the presupposition justification of durch applies at a word-internal level, effects involving global, local or intermediate accommodation (Beaver & Zeevat, to appear) are not expected either (but see the two possible modification in example (16) above).

One test which does seem to be more or less straightforwardly applicable, though, is the negation test, which involves a non-entailing context, in which a presupposition should still be true:

\begin{align*}
(17) \quad \text{Er starb nicht durch einen gezielten Schuss.} \\
\text{'He did not die through an accurate shot.'}
\end{align*}

Now, it doesn't make sense to consider the truth of CAUSE alone, but it can be observed that the CAUSE of durch does seem to survive negation. The most obvious interpretation of (17) is one where the person in question dies, but where the cause of his death is not an accurate shot, i.e. the negation has narrow scope over the durch-adjunct. Importantly, (17) is interpreted as claiming that there was a cause for the person's death, but that the reason was not an accurate shot. Thus, the presuppositional part of the durch-phrase, consisting of the CAUSE-predicate, can be said to survive negation.

It is possible to get a sentential negation reading of nicht in (17), but this is a more unlikely reading. The reason for this could be that it does not make sense to add a causal adjunct like by a shot if one wants to express that a person did not die (cf. Solstad, in preparation).

Since presuppositions in general are assumed to be verified also intersententially, it might be an additional argument for analysing the CAUSE part of the semantics of durch as being a presupposition if it could also be justified sentence-externally. There is at least one type of occurrence where a claim can be made that this is the case:
(18) Sie hat Geld verloren. Es geschah durch Unaufmerksamkeit. 'Sie lost some money. It happened due to lack of attention.'

In the second sentence in (18) containing the durch phrase, the abstract event predicate geschehen ('happen') is used, which asserts that some event took place. What durch modifies semantically however, is the predicate verlieren ('lose') in the first sentence. Thus, in the case of (18), part of the presuppositional information in the store of durch is bound by an event variable in the preceding sentence.8

5 A wider perspective

An approach like the one sketched above has applications beyond the analysis of durch. First, unification as a mode of composition has been applied in an analysis of the semantics of by in English (Sæbø, to appear) using a somewhat different version of the DRT formalism sketched in section 3. Second, there are causal prepositions in other languages which show a behaviour similar to durch. In English, through can also be combined with both causative and inchoative predicates. More interestingly, given the close relationship between English through and German durch, a language more remotely related to German such as Bulgarian also has a preposition, ot ('from'), which combines with causatives and inchoatives:

(19) a. Toj be ubit ot tri kurshuma. He was killed from three bullets 'He was killed with three shots.'
    b. Toj zagina ot tri kurshuma. He died from three bullets 'He died from three shots.'

Third, there are other types of adverbial modification, where the above analysis can be applied plausibly, as illustrated in (20):9

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8 It may be added that it is possible to see the presupposition of durch as purely sentence-internally verified if it is assumed that geschehen ('happen') and the event anaphor es ('it') are identified with information in the preceding sentence, such that it is available for word-internal modification in the second sentence. This conflicts, however, with the general assumption that event variables are bound before the level of CP is reached, i.e. before any preceding context is considered.

9 Thanks are due to Christopher Habel for pointing my attention to this example.
In (20a) the adverbials *in das Haus* ('into the house') and *hinein* ('inside', in addition to viewpoint information) specify a single path of movement. They are not interpreted as describing two paths which are combined. There is a double specification of an *in* movement (i.e. *into* as opposed to *out of*), once in the preposition *in* and once in the *hinein* element. In addition, directionality is specified twice, both in the combination of the preposition with accusative case, and in the *hinein* element. As can be seen from (20b-c), either of the adverbials in (20a) can occur without the other.

In the framework presented here, the *hinein* element would be assumed to carry the presupposition that there is an object into which movement takes place. In (20a) this presupposition is sentence-internally verified, whereas it will have to be verified in a wider context or accommodated in (20c). The information on directionality and inwards movement of the two adverbials is unified whenever they both occur, as in (20a).

In sum, these data suggest that the presuppositional analyses of Kamp (2001) and van der Sandt (1992) in combination with unification-based composition can be suitably applied in analysing lexical items other than e.g. particles and factive verbs.

6 Conclusion

In this paper, it was argued that an analysis applying strict compositionality is not always a viable option. The varying compositional impact of German adverbials headed by the causal-instrumental preposition *durch* was argued to be better rendered in a unificational framework. It was further argued that pragmatic mechanisms are important in describing the combinatorial distribution of some lexical items, and that what seems to be unification may be argued to be rather word-internal presupposition justification.

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10 Until now, I’ve honoured Kjell Johan by keeping his name out of the violent examples.
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References


